Simultaneous measurements of thermal conductivity and heat capacity of polymer plate using temperature profiles at a quasi steady state

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In order to measure the thermophysical properties of a new material and calibrate the thermophysical properties of a material using different method, it becomes advantage to measure the several properties at the same time. The aim of this work is to develop a simultaneous measuring method having an accuracy of within 10 % for measuring the thermal conductivity and heat capacity of materials using the temperature profiles of the specimen at a quasi steady state. The method is similar to that proposed by Krischer et al. [1]. One surface of a specimen is continuously heated with a constant heat flux and the other is covered with thermal insulation. When the temperature of the specimen has reached to a quasi steady state, the temperature difference and temperature increase of the specimen is nearly constant. The thermophysical properties are calculated with the temperature differences, the temperature increase with time and the heat input at the quasi steady state.

We made an experimental apparatus suitable for the size of specimen 50 mm square in area and 10 to 20 mm in thickness, and measured the thermophysical properties of two polymer plates to evaluate the accuracy of measurement. Specimens, the thermal conductivity and heat capacity of which are measured using the guarded hot plate apparatus and the differential scanning calorimeter, respectively, were an acrylic resin and a polyethylene plates. The heat source had the same area as the specimen.

The present paper describes the principle of method, the experimental apparatus, the effects of the temperature profiles of the specimen and the heat input of the heat source on the measurement, and the accuracy of the measurement.

[1] O. Krischer and H. Esdorn, VDI – Forschungs – Heft 450, 29 – 39, (1954).